Dealing with Soil Compaction Considering Equipment of Today

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Iowa State University
(retired)
<table>
<thead>
<tr>
<th>Depth</th>
<th>Soil Vertical Stress, psi</th>
<th>Semi-trailer</th>
<th>Pipelayer</th>
</tr>
</thead>
<tbody>
<tr>
<td>8 in.</td>
<td></td>
<td>19</td>
<td>19</td>
</tr>
<tr>
<td>16 in.</td>
<td></td>
<td>11</td>
<td>17</td>
</tr>
<tr>
<td>24 in.</td>
<td></td>
<td>6</td>
<td>9</td>
</tr>
</tbody>
</table>

Semi-trailer, 10 ton/axle
Cat Pipelayer PL 87, 53.4 tons
“Soil compaction, which is aggravated by harvesting in the mud, is a growing concern of some farmers. Research shows that loads of 5 tons per axle can cause deep compaction that’s not alleviated by freezing and thawing or readily removed by subsoiling. . . . Big grain carts can also compact soil. . . . In extreme cases, farmers may have to decide whether a current crop in a wet field is worth more than the cost of battling mud and possibly reducing future yields by increasing compaction.”

- Grain harvesting in the 1990’s, Implement & Tractor, July 1988, Frank Buckingham
Agricultural axle weights

Combine w/300 bu
Manure tank wagon
Grain cart w/1200 bu
Tractor, 330 hp, FWA

<table>
<thead>
<tr>
<th>Equipment</th>
<th>Per axle</th>
</tr>
</thead>
<tbody>
<tr>
<td>Combine w/300 bu (front axle)</td>
<td>24 tons</td>
</tr>
<tr>
<td>Manure tank wagon</td>
<td>18</td>
</tr>
<tr>
<td>Grain cart w/1200 bu (single axle)</td>
<td>46</td>
</tr>
<tr>
<td>Tractor, 330 hp, FWA (rear axle)</td>
<td>12</td>
</tr>
</tbody>
</table>
Effects of spring tractor tracks

Tractor tracks

Rows

Erbach et al., 1988
4 year average, '84–'87
Continuous corn

<table>
<thead>
<tr>
<th>Location</th>
<th>Pop/a</th>
<th>Yield, bu/a</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tractor track</td>
<td>22,700</td>
<td>143</td>
</tr>
<tr>
<td>Non-track</td>
<td>23,500</td>
<td>166</td>
</tr>
<tr>
<td>Track</td>
<td>23,600</td>
<td>148</td>
</tr>
<tr>
<td>Wheel</td>
<td>22,200</td>
<td>139</td>
</tr>
</tbody>
</table>
### Track Position Effect on Corn Growth

<table>
<thead>
<tr>
<th>Location</th>
<th>Yield, bu/a</th>
</tr>
</thead>
<tbody>
<tr>
<td>No tracks</td>
<td>157</td>
</tr>
<tr>
<td>Single-track, one side</td>
<td>154</td>
</tr>
<tr>
<td>Double-tracks, one side</td>
<td>150</td>
</tr>
<tr>
<td>Tracks on both sides</td>
<td>157</td>
</tr>
<tr>
<td>Track on-row &amp; both sides</td>
<td>121</td>
</tr>
</tbody>
</table>

3 year average, ’93-’95
Webster silty clay loam
Kanawha, IA
Corn-soybean

Kaspar and Erbach, 1996

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**Compaction and subsoiling, central and southeast IA**

In only 1 of 9 site-years of data did compaction from 10- or 20-ton axle loads show significant yield reduction.

Subsoiling also generally did not affect yield, and in 2 of 3 cases reduced yield.

Melvin et al., 1994
Compaction and subsoiling, northwest OH

Corn and soybean yields were reduced 3 of 4 years during years with 10- and 20-ton axle loads applied. Residual effect on yield also present with 20-ton axle load for 1 year on corn and 3 years on soybeans.

Subsoiling generally increased yields, although not always statistically significant.

Al-Adawi and Reeder, 1996
No pass 1 pass 4 passes

Bulk density, g/cc

15 t single axle load
30 psi
Wood et al., 1991
Management tools

- Avoid trafficking wet soils
- Control traffic in established lanes
- Use correct tire pressure for load carried

Additional management tools

- No-till or reduced tillage if wet spring planting season
- Grain cart paths in fall
- Controlled traffic considered during machine purchase
What’s your plan?

- short term (this spring, next year or two)
- long term